

## CLAIMS

1. For use in an ultra wideband (UWB) communication system, apparatus capable of directing selected UWB pulses to and from selected multiple users, the apparatus comprising:

a wideband antenna structure having multiple arrays, each array having multiple antenna elements; and

means for separating UWB pulses into individual user streams of pulses and applying each user stream to the antenna structure in such a way as to generate individual user beams containing only pulses intended for those respective users.

2. Apparatus as defined in claim 1, wherein:

the means for separating UWB pulses into individual user streams comprises means for assigning to each user a particular allocation of UWB time slots.

3. Apparatus as defined in claim 1, wherein:

the means for separating UWB pulses into individual user streams comprises means for applying each user stream to a different segment of the antenna.

4. Apparatus as defined in claim 1, wherein:

the means for separating UWB pulses into individual user streams comprises means for assigning to each user a unique combination of a UWB frequency and an antenna array, whereby the UWB pulses transmitted to or from particular users are all uniquely identifiable and any user may receive or transmit UWB pulses at the same time as other users, without significant interference.

5. Apparatus as defined in claim 4, wherein the means for separating UWB pulses into user streams comprises:

a plurality of beam forming networks, each associated with a separate one of the multiple antenna arrays, and each comprising a plurality of variable time delay circuits, wherein the time delay circuits interpose different sets of selected time delays for UWB

pulses applied to the successive array elements, to direct different pulses along beam paths to respective users; and

means for generating beam steering signals to the beam forming networks, to switch the beam forming networks to effect beam steering toward selected users served by each antenna array.

6. Apparatus as defined in claim 5, wherein:

each beam forming network is switchable to direct beams to a plurality (m) of users associated with each antenna array;

the antenna structure has n arrays, for a total of mn users;

UWB pulses for each of the mn users have a carrier frequency selected from a plurality of available frequencies; and

the frequencies are reused in a spatial sequence such that the beam associated with any user is spatially separated from other user beams using the same frequency.

7. A method for transmitting ultra wideband (UWB) pulses to selected multiple users, comprising the steps of:

separating UWB pulses by individual user; and

applying the UWB pulses to a wideband antenna structure having multiple arrays of multiple antenna elements.

8. A method as defined in claim 7, wherein:

the step of separating UWB pulses comprises assigning each user a particular allocation of time slots in a stream of UWB pulses.

9. A method as defined in claim 7, wherein:

the step of separating UWB pulses comprises applying each user's pulses to a different segment of the antenna structure.

10. A method as defined in claim 7, wherein:

the step of separating UWB pulses comprises assigning to each user a unique combination of a UWB frequency and an antenna array, whereby the UWB pulses transmitted to or from particular users are all uniquely identifiable and any user may receive or transmit UWB pulses at the same time as other users, without significant interference.

11. A method as defined in claim 10, wherein:

the step of separating UWB pulses comprises forming beams in a plurality of beam forming networks, each associated with a separate one of the multiple antenna arrays, wherein the step of forming beams includes interposing different sets of selected time delays for UWB pulses applied to the successive array elements, to direct different pulses along beam paths to respective users; and

the method further comprises generating beam steering signals to the beam forming networks, and thereby switching the beam forming networks to effect beam steering toward selected users served by each antenna array.

12. A method as defined in claim 11, wherein:

the step of switching the beam forming network functions to direct beams to a plurality (m) of users associated with each antenna array;

the antenna structure has n arrays, for a total of mn users; and

the method further comprises selecting, for each of the mn users, a UWB carrier frequency from a plurality of available frequencies, and reusing the frequencies in a spatial sequence such that the beam associated with any user is spatially separated from other user beams using the same frequency.